Notes by Charles Sumner Tainter, October 23, 1881, with transcript

Copied from pages 97 to 113 inclusive in Laboratory Rough Notes, Vol. XIII. Folder, Graphophone, The Graphophone. 1879–99 Sunday Oct. 23d, 1881. drawer 12

The following is a copy of a portion of the written matter contained in the sealed package marked “Package No. 1. V. L. A.” which was deposited in the Smithsonian Institution October 20th 1881.—

Sumner Tainter.

(Inscription upon outside cover of Package.—)

Washington, D. C. October 20th 1881.

Package No. 1. V. L. A.

Deposited in the Smithsonian Institution on the 20th day of October 1881 by the undersigned, on behalf of Alexander Graham Bell, Sumner Tainter, and Chichester A. Bell.

(signed) Sumner Tainter. Chichester A. Bell.

(Portion of written matter inside Package.—)

We, Alexander Graham Bell; Sumner Tainter; and Chichester A. Bell, having associated ourselves together for the joint prosecution of inventions and experiments, desire to put on record a process and apparatus which we have devised for recording sound-vibrations, and for reproducing the sounds from the record, without deterioration of the record itself.

Library of Congress

For some months previous to the present date (September 1881) our invention has been practically perfected, but we still withhold publication in the hope that our continued efforts may result in a more simple form of apparatus, adapted for popular use.

The possibility of reproducing the sounds of articulate speech from a record was demonstrated several years ago by the construction of the Edison Phonograph, but 2 the articulation of the instrument was, at best, very imperfect and disagreeable; and the indented tinfoil record soon became deteriorated by use, so that the words impressed upon it ceased to be reproduced after a very few repetitions.

Our aim has been to produce a record of such an improved character as to be capable of yielding a perfect articulation with agreeable vocal quality* and to devise a means of reproducing the sounds without touching the record so as to avoid deterioration.

We believe that the perfection of such an instrument will be a contribution to the world's utilities of little less consequence than the invention of the art of printing and our ambition is, by simplification of apparatus, to make the use of the Phonograph and Graphophone as universal as that of the printing press and its products.

Our invention consists in the first place of a new form of Phonograph, or apparatus for recording sounds by the voice; and in the second place of a new kind of Graphophone, or apparatus for producing sounds from a Phonogram or permanent record. The Phonograph consists of a flexible diaphragm which can be thrown into vibration by the voice, and which communicates its vibrations to an engraving tool resting upon a film or coating of wax, paraffine, or other similar substance on or into which the voice-record is to be engraved. The end of the cutting tool presses against the prepared substance, and cuts out a groove of considerable width as the prepared substance is moved past the end of the tool. Under these circumstances when a person speaks against the diaphragm of the Phonograph its vibrations are communicated to the tool so as to cause a to-and-fro motion of the end in contact wit the prepared substance. This motion may be either in a plane parallel to

the surface of the prepared substance so as to produce a wavy of zig-zag line of uniform depth; or it may be in a plane perpendicular to the surface so as to cut out a straight groove of varying depth, as may be desired. A Phonogram of either of these kinds may be copied in more durable materials, by any of the well-known moulding our electro-plating processes; and the sounds may be reproduced either from the original Phonogram as from one of the copies.

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The Graphophone consists essentially in a reservoir of compressed air, and in a small nozzle by means of which an extremely fine jet of air can be directed into the groove constituting the Phonogram. Under these circumstances when the Phonogram is caused to move past the end of the nozzle in the same manner that it had originally been moved when the Phonogram was made, the impinging jet of air is thrown into acoustic vibration by the Phonogram, and the sounds recorded on it are heard with all their original qualities by an ear placed near the apparatus.

If the pressure of air in the reservoir is sufficiently great the sounds are audible at a considerable distance from the apparatus; but with a feeble current the articulation is very clearly and distinctly perceived by listening through a hearing tube the open end of which is placed in close proximity to the nozzle of the Graphophone.

Similar results would probably also be obtained by using a mould or obverse of the original record, in which case the Phonogram will consist of ridges instead of grooves and the stream of air striking on the raised Phonogram will be thrown into corresponding acoustic vibrations.

We append drawings, and tracings from drawings, of experimental forms of apparatus already constructed, together with reference to our Note-books in which experiments are described.

(Signed) Alexander Graham Bell. Sumner Tainter. Chichester Alexander Bell.

The following words and sounds are recorded upon the cylinder of the enclosed Graphophone: T-r-r — T-r-r —. There are more things in heaven and earth Horatio, than are dreamed of in our philosophy — T-r-r — I am a Graphophone and my mother was a Phonograph.

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Upon the 25th of September 1881 the Graphophone with the above words and sounds recorded upon the cylinder, was arranged as shown in the diagram on page 41 — Vol. III of Sumner Tainter's Home Notes, a copy of which is enclosed.

An air pressure in the reservoir A. of from 40 to 80 lbs. per square inch was used; but owing to some defect in the apparatus, the loudness of the sounds reproduced was much inferior to that obtained in experiments made last July with the same air pressure.

The following persons were witnesses of the experiments made Sept. 25th:—Mrs. G. G. Hubbard, Miss Grace B. Hubbard, Mrs. David C. Bell and Prof. A. Melville Bell. Since these experiments were made we have slightly enlarged the aperture of the glass jet by cutting off a portion of the end which has been found to improve the loudness of the sounds reproduced. With this exception the apparatus in this pocket is in the same condition as when used in the experiments made on the 25th of September.

We also inclose an electro-type copy of a Phonogram, which has just been completed. This copy, which is the reverse of the original was made in the following manner:—

A think disk of metal was placed in the lather and a recess turned in one side thus:— Recess. This recess was then filled with the paraffine-wax composition, (paraffine #, wax #) and again placed in the lathe, when the surface was turned off flat and smooth. A diaphragm and mouth-piece were then fitted to the slide-rest of the lathe, and a lever

attached to the center of the diaphragm carried a cutting tool as shown in the next diagram.

When the lathe revolved the mouth-piece, lever and cutting tool, received a slow and regular motion towards the center of the disk held in the chuck of the lathe, 5 and the result was a spiral line traced upon the surface of the composition.

When no sounds were uttered this line was smooth and regular; but when words and sounds were shouted into the mouth-piece, the vibrations of the diaphragm were communicated to the cutting tool and corresponding irregularities formed in the sprial groove.

The disk with the record or phonogram upon it, was then placed in the well known mixture used for silvering mirrors and a film of pure silver deposited upon the phonogram. It was then placed in a solution of sulphate of copper, and connected to a battery of one cell; the second pole of the battery being connected to a plate of copper placed opposite the phonogram as in the ordinary arrangements for electro-plating.

After remaining in the plating solution about 40 hours the phonogram was taken out and gently heated over a lamp until the copper film separated from the composition.

The irregularities and holes in the copper film are due to the irregularity of the silver film, as the solution acted upon the metal of the disk (zinc) and caused a poor deposit of silver upon the phonogram.

The phonogram copied in this case is of the zig-zag form but there is nothing to prevent copies of an Edisonian record being made in the same manner.

It is our intention to “back” an electro-type of this kind with a solid plate of metal and then use it as a stamp or die for forming copies in various material from each of which the original sounds can be reproduced.

(Signed) Sumner Tainter. Chichester A. Bell. (Copy of the receipt given by the Smithsonian Institution for the Sealed Package.—)

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Memorandum.

Washington, D. C., October 20 1881.

Received from the Volta Laboratory Association for deposit in the confidential archives of the Institution a sealed package in box, marked “Package No. 1. V. L. A.” to be delivered on the written request of two of the members named on the cover of said package.

(Signed) Wm. B. Taylor. for Wm. J. Rhees, Chief Clerk Smithsonian Institution.

The remainder of the written matter contained in the package — (which consists of copies of notes and tracings of drawings in the Lab. Rough Notes, Vol. XIII, A. Graham Bell's Home Notes Vol. III)— will be found in the books above mentioned where it is indicated by a single dark line drawn to the left and parallel to the red lines on the right-hand pages.

Noted by S.T. Oct. 23d, 1881.